

Integrating Sustainability and Digitalization in Green Business Models

Dr. Marjina Ahmed

Assistant Professor, Department of Management, Chhaygaon College, Chhaygaon

Abstract-- Green business models focus on sustainability by minimizing environmental impact while remaining economically viable. Digital marketing plays a crucial role, enabling businesses to promote eco-friendly products, build brand loyalty, and connect with environmentally conscious consumers. This includes strategies like promoting green products, using eco-friendly messaging, and optimizing digital platforms for energy efficiency. Sustainability is no longer a niche concept- it's a fundamental business drive shaping industries across the globe. Green business models, also focused a sustainability and incorporating digital marketing, are gaining attraction as businesses respond to growing consumer awareness of environmental issues. These models integrate eco-friendly practices throughout the business, from product development to marketing, aiming to minimize environmental impact while remaining profitable. Digitalization plays a crucial role by enabling businesses to reach environmentally conscious consumers, promote sustainable products, and build a positive brand image. The main purpose of this research paper is to study the green business models in relation to sustainability digitalization and also to create structures ways for businesses to integrate digitalization with sustainability principles into green business models, leading to competitive advantages. This research paper is based on secondary data only. The data is collected from various articles and literature review is done by online available studies and journals. This study show that digitalization significantly enhances green business models by facilitating digital green innovation, enabling data-driven decision making, optimizing resource efficiency, and improving customer engagement for sustainability goals. In essence, this paper is concluded with that digitalization is not just a tool but a foundational enabler for green business models, transforming them into more sustainable, efficient, and profitable enterprises capable of meeting future environmental and societal demands.

Keywords-- Green Business Models, Sustainability, Eco-friendly, Digitalization, Brand image.

I. INTRODUCTION

Green business models focused on sustainability and incorporating digital marketing, are gaining attraction as businesses respond to growing consumer awareness of environment issues.

These models integrate eco-friendly practices throughout the business, from product development to marketing, aiming to minimize environmental impact while remaining profitable. Digital marketing plays a crucial role by enabling businesses to reach environmentally conscious consumer, promote sustainable products, and build a positive brand image.

Key Aspects of Green Business Models:

- i) *Focus on Sustainability:* Green business models prioritize reducing environmental impact, often incorporating circular economy principles and sustainable sourcing.
- ii) *Green Marketing:* This involves promoting products and services with environmental benefits, using eco-friendly packaging, and adopting sustainable marketing practices.
- iii) *Digital Transformation:* Digital marketing tools and platforms are used to reach target audiences, promote sustainable products, and engage consumers in eco-friendly behaviours.
- iv) *Transparency and Authenticity:* Businesses need to be transparent about their green initiatives and avoid green-washing (misleading claims about environment friendliness).
- v) *Challenges and Opportunities:* While green marketing can be more expensive in the short-term, it offers long-term benefits by attracting environmentally conscious consumers and enhancing brand reputation. Examples: green social media campaigns, eco-friendly advertising, sustainable content production, and energy-efficient website designs are some ways to implement green digital marketing.
- vi) *Role of AI and Technology:* Advanced technologies like AI, big data, and block chain are being explored to optimize green business models and enhance sustainability efforts.

In essence, green business models, supported by digital marketing, represent a shift towards more sustainable and responsible business practices.



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Concept Of Sustainability:

Sustainability is the ability to maintain or support economic, environmental, or social process overtime without depleting natural resources. In the broadest sense, sustainability refers to the ability to maintain or support a process continuously overtime. In business and policy contexts, sustainability seeks to prevent the depletion of natural or physical resources, so that they will remain available for the long term.

Sustainability is the ability to maintain or support economic, environmental, or social processes overtime without depleting natural resources.

Concept of Digitalization

Digitalization is a digital transformation process that involves the integration of digital technologies into all areas of a business, leading to fundamental changes in how the business operates and delivers value to its customers. The dynamic and rapidly evolving digital landscape is driving disruptive change across all industries.

II. SIGNIFICANCE OF THE STUDY

Studying green business models is significant because it demonstrates how businesses can balance profit with social and environmental responsibility, addressing global challenges like climate change and resource depletion. Such studies provide practical strategic for sustainable operations, foster innovation, enhance brand reputation, and attract conscious consumers and investors, ultimately contributing to economic growth and a thriving green economy.

Studies on green business models are crucial for understanding and implementing solutions to pressing issues like climate change, resource scarcity and biodiversity loss. Green models emphasize waste reduction recycling, and the efficient use of renewable resources, creating close-loop. It is also significant because it promotes environmental sustainability, fosters economic viability and innovation, enhances corporate reputation, and addresses societal and regulatory demands for a green economy. Such research provides actionable insights into integrating circular economy principles, using renewable energy, minimizing waste, and developing sustainable supply chains, helping businesses transition from traditional environmentally harmful practices to more resilient, profitable, and socially responsible models.

Studying green business models with digitalization is significant because it drives economic growth through enhanced brand loyalty and a competitive advantage, while promoting environmental sustainability by aligning business strategies with consumer demand for eco-friendly products and practices. This combination allows companies to foster corporate social responsibility, reduce costs, build resilient operations, and effectively communicate their sustainability efforts to a growing market of conscious consumers.

Green business must ensure the presence of these main green business models:

- i) Green product design
- ii) Green efficient and localized production
- iii) Product service systems
- iv) Prosumers and co-creation
- v) Consumers choice influencing
- vi) Collaborative consumption
- vii) Waste as a resource
- viii) Green supply chain management
- ix) Closed-loop
- x) Organic and biodegradable production.

III. REVIEW OF LITERATURE

Literature review highlight that digital technologies are essential for green business models, improving resource efficiency, enabling collaborative circular economies, and enhancing transparency in supply chains through tools like Radio- Frequency Identification (RFID). Digitalization supports, sustainability by facilitating smart solutions, reducing waste, and connecting stakeholders for common environmental goals. However, studies also note potential negative impacts of digital adoption, such as increased resource consumption and rebound effects, emphasizing the need for careful integration to achieve true sustainability.

- Guandalini (2022) in her study describes that motivated by the rising attention of businesses and regulators towards how digital transformation can assist sustainability improvement, this paper sheds light on the relationship between this two phenomena. Specifically, this research pioneers the study of 'digital sustainability' through a systematic review of 153 academic articles aimed to consolidate the existing research to understand the thematic connections amongst the different studies, and to identify research gaps to move forward in the development of the topic.

The suggested research agenda has important theoretical and practical implications. Through the identified gaps, this study, acknowledges the management scholarship of pitfalls and delays on the research topic, providing detailed guidance to develop this new area of subject area. The opportunistic approach of this paper responds to the practical call for support in understanding the use of digitalization for sustainability related goals. This research directly impacts a wide range of practitioners, including managers, consultants, and policymakers.

- According to Najmaei & Sadeghinejad (2022) over the last decades, and sustainable business models (GnSBMs) have become a prominent topic of discussion among scholars, practitioners and policymakers. Preponderance of research and an increasing global pressure to adopt green and sustainable business models necessitate a comprehensive understanding of the state of research on green and sustainable business models. Towards this end, we extracted 851 publications on green and sustainable business models from the scopus database and employed a series of bibliometrical techniques to explore the historical roots and sleeping beauties, assess the life cycle, map the conceptual evolution and propose a research agenda for this growing field. Their analysis revealed that research on green and sustainable business models is moving from a multidisciplinary to an interdisciplinary domain. Its historical roots can be traced to the pioneering works on business strategy in the 1950s, environmental science in the early 1960s, and stakeholder theory in the 1980s. Life cycle analysis indicated that research on green and sustainable business models went through an introductory stage from 2002 to 2013 and then began to rapidly grow in 2014, and this growth in forecast to continue until circa 2040. These conceptual structures from 2002 to 2013 and 2014 to 2020 were mapped and an agenda for future research was proposed.
- Broccardo et.al. (2023) : This paper explores the relation between two megatrends, digitalization and sustainability. It is a structured literature review, based on the concept of sustainable model. There is a potential virtuous, reinforcing cycle between digitalization and sustainability. New digital technologies are becoming widespread and have radically redefined business processes and practices.
- Simultaneously, numerous companies are implementing sustainable business models (SBMs), expecting to integrate sustainability considerations and increase competitive advantage. These two megatrends- are radically changing firms. However, the relationship between digitalization and the implementation of SBMs is yet to be investigated in detail. This is a key issue, as digital tools could assist companies in transforming their current business models toward sustainability. Through a literature review, we explore the link between digitalization and SBMs illustrating the main potential impacts of digitalization for each block of SBM and propose a list of the potential benefits that digitalized SBMs can bring. We identify these potential benefits and elaborate on them considering their economic, social and environmental impacts. Moreover, their study identifies a potential virtuous circle generated by digitalization, while highlighting the necessary alignment of digital tools and key business factors to attain economic, social, and environment value.
- Palmie et.al. (2024) in their study explained that business models have become one of the most prominent topics in the strategy field and have pervaded other domains of management research as well. Consequently, considerable effects have been undertaken to study business models in the context of megatrends like digitalization and sustainability, leading to literature streams on digital business models. Both literature streams have begun to account for the other megatrend so that their research interests increasingly overlap. Similarly, strategic and general management scholars have recently become interested in the intersection of digitalization and sustainability. To provide a solid foundation for this future strategy research, this article proposes a definition of digital sustainable business models, develops an integrative strategic management framework from seminal accounts of the strategy field, synthesizes the fragmented prior investigations at the intersection of digitalization, sustainability and business models in a systematic literature review, and identifies promising avenues for future research by applying the framework to the findings from the literature synthesis.
- Xu, Zhang and Whang (2024) in their study highlights digital sustainability orientation has a significant positive impact on digital green innovation.

Digital orientation also helps to promote digital green innovation, but the effect is weaker than that of digital sustainability orientation. This may be because digitalization creates a technical availability basis for green innovation but cannot generate continuous green innovation upgrade momentum, reducing the sustainability of digital green innovation but cannot generate continuous green innovation upgrade momentum, reducing the sustainability of digital green innovation with the help of digital technology. Digital sustainability orientation has the strongest positive impact on digital green innovation, which indicates that the two strategic orientations can generate a synergistic and complementary effect and enhance digital green innovation. This conclusion is both a verification of the interactive effect of strategic orientation proposed by Hakala and a supplement to the initiative of scholars George and Schillebeekx to deepen the research on the theoretical knowledge system of digital sustainability, which promotes the theoretical development of digital sustainability research,

- Bargavi et.al. (2025) in their study portrays that sustainable business models (SBMs) because of their economic performance and environmental sustainability. This article examines the challenge and potential and potential of SBMs through entrepreneurship, innovation, and digitalization in Indian SMEs. Based on a large data analysis, they investigate the impacts of digital transformation, government support and entrepreneurship based on sustainability on(Small and Medium-sized Enterprises) SMEs growth and resilience. Financial limitations, poor technological infrastructure and regulatory issues are quoted as the main deterrents to Indian SMEs adopting sustainable business models at scale. Green product demand growth, government pro-incentive policies and digitalization are the main opportunities that can help sustainable business models mainstream sustainability in their business models. The research methodology integrates primary data gathered from 200 SME entrepreneurs and secondary data from Ministry of MSME, NITI Aayog, and international organization reports. Statistical analysis finds a robust correlation between digital adoption and sustainability performance, where digitalized SMEs are more efficient and sustainable in their sustainability practices.

- Regression analysis indicates government support market demand and investment in digitalization as key driver's of effective SBM implementation in Indian SMEs need to embrace long term sustainability through encouraging innovation, digital uptake, and collaborative partnership with policymakers and industry players critical policy intervention includes enhanced finding schemes for sustainable SMEs, efficient regulation processes, and targeted digital literacy programs. The current research is a contribution to the literature in the form of empirical evidence of India's SME's sustainability transformation. Future research may study sector-specific SBM strategies and comparative studies with other emerging economies SMEs to continue enriching knowledge on sustainable business practices.

IV. OBJECTIVES OF THE STUDY

The following are the objectives of the study:

- i) To create structured ways for businesses to integrate digitalization with sustainability principles into green business models, leading to competitive advantages.
- ii) To assess the broader economic, social and environmental implications of digitalization for sustainability, including addressing challenges related to e-waste, data privacy and digital inclusivity.
- iii) To investigate how digital tools and green business models can optimize the use of raw materials, water and energy.

V. RESEARCH QUESTIONS

Green business models and sustainability, digitalization often explore how digitalization enables sustainable practices and innovation, the challenges and opportunities of this integration, the impact on specific sectors like SMEs or manufacturing, and how this supports broader goals such as the United Nations Sustainable Development (SDGs).

VI. RESEARCH METHODOLOGY

Research methodology is a science of studying how research is to be carried out. It is a systematic way to solve a problem. Research methodology deals with the research methods and takes into consideration the logic behind the methods.

In respect of the present research objectives, the methodology has been described:

i) Research Design:

The nature of the study is both exploratory and descriptive. It is exploratory as the study aims at identifying the structured ways for businesses to integrate digitalization with sustainability principles into green business models, leading to competitive advantage.

ii) Source of Data:

The study is based on secondary data. The data is collected from articles and literature review is done by online available studies and journals.

VII. FINDINGS OF THE STUDY

Studies show that digitalization significantly enhances green business models by facilitating digital green innovation, enabling data-driven decision-making, optimizing resource efficiency, and improving customer engagement for sustainability goals. The key findings highlight that digital tools and strategies create a virtuous cycle of value creation, reducing operational costs and fostering innovation across economic, social, and environmental dimensions. However, challenges like data security, ethical concerns, and the potential for increased energy consumption require careful management for successful implementation.

Key Findings:

- i) Facilitate Digital Green Innovation:* Digitalization, including AI, IoT, and big data, drives innovation in green practices, allowing companies to develop sustainable products and processes more efficiently.
- ii) Drives Efficiency and Cost Reduction:* Digital tools like predictive analytics and smart processes improve resource allocation reduce operational costs, and enhance overall efficiency, leading to economic benefits for businesses.
- iii) Enhances Customer Engagement:* Digital technologies help businesses understand evolving customer needs, allowing for better customer segmentation and engagement in sustainability initiative, which is crucial for growth.
- iv) Enable Data- Driven Decision –Making:* Abundant data and computational capabilities allow for more informed, data-driven decisions, regarding environmental risks, resource management, and strategic planning for sustainability.

- v) Addresses Market Dynamics:* Digitalized systems provide businesses with greater ability and responsiveness to market changes and increasing customer demand for eco-friendly products and services.

Findings of the Objective No.1

Businesses are engaging in a structured race to integrate digitalization and sustainability for competitive advantage by developing green business models that leverage digital technologies to optimize resource use, improve operational efficiency, foster green innovation, and enhance stakeholder engagement, ultimately leading to economic, social and environmental benefits. Key technologies include AI, IoT, and block-chain, which enable real time monitoring, waste reduction, and better decision making, while also presenting challenges such as high implementation costs and the need for a supportive organizational culture for successful adoption.

Findings of the Objective No.2

Digitalization offers sustainability benefits through efficiency gains but poses challenges like increased e-waste from faster product cycles, threats to data privacy and cyber-security and the widening digital divide, which can include vulnerable populations. Addressing these requires fostering sustainable digital design, promoting circular economies fore-waste, ensuring equitable digital access, and implementing strong data protection regulations to balance economic growth with environmental stewardship and social equity.

Findings of the Objective No. 3

Digital tools and green business models optimize raw material, water, and energy use by enabling real-time data monitoring and analysis through technologies like IOT and AI to identify inefficiencies foster circular economy initiatives, and improve supply chain transparency, leading to reduced waste, lower operational costs, and increased environmental sustainability.

VIII. CHALLENGES AND CONSIDERATION:

- i) Potential for increased energy consumption:* While digital transformation offers green benefits, it can also lead to increased energy consumption, particularly electricity demand, which negatively impacts the environment if not managed effectively.

ii) *Data Security and Ethical Concern*: Integrating AI and other technologies presents challenges related to data privacy, security, and ethical implementation, which must be addressed to foster trust and successful adoption of sustainability-focused AI initiatives.

iii) *Technological Literacy*: Variations in technological literacy and the availability of digital infrastructure across different regions and within various organizations can create barriers to the full realization of the benefits of digitalization for sustainability.

The studies consistently show that integrating digitalization and sustainability is transformative for business models. It provides a framework for creating competitive advantages by fostering innovation and efficiency, ultimately contributing to a more sustainable and inclusive future.

IX. CONCLUSION

Green business models are effectively amplified by digitalization, which drives efficiency, innovation, and sustainability by enabling better resource allocation, optimizing supply chains, and fostering green technology adoption. Integrating digital capabilities with an environment focus, or a “digital sustainability orientation” creates a powerful synergy that improves green innovation, reduces operational costs through optimization, and enhances competitive advantage. The conclusion is that strategic integration of digital tools and processes is crucial for developing successful, profitable, and environmentally responsible businesses.

Digitalization allows for more efficient resource utilization, reduced waste, and optimized industrial processes, leading to lower operating costs. Digital technologies foster operating costs. Digital technologies foster a culture of green innovation, enabling the development of eco-friendly products and services and improving the efficiency of existing green technologies. Digital transformation provides better oversight across the entire product lifecycle and enables timely, intelligent decision-making, which supports green innovation. By developing green dynamic capabilities through digitalization, companies can gain a unique market position, improve financial performance, and increase their long-term competitiveness.

Digital tools can optimize supply chains, leading to increased efficiency and a reduction in resource consumption and carbon emissions, as seen in areas like air traffic management. A strong environmental consciousness among managers, coupled with digital capabilities, can lead to the identification of new market prospects for green products and services. Businesses must cultivate a “digital sustainability orientation” which is the integrated effect of digital and sustainability perspectives, to effectively promote digital green innovation. Investing in digital tools and capabilities allows companies to achieve higher levels of green innovation output and capabilities allows companies to achieve higher levels of green innovation output and attract external investors who recognize the positive impact of sustainability initiatives. Digital technologies can facilitate the promotion of a green innovation culture within organizations, enabling employees to champion and implement sustainable practices. In essence, digitalization is not just a tool but a foundational enabler for green business models, transforming them into more sustainable, efficient, and profitable enterprises capable of meeting future environmental and societal demands.

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